- The degree of mitigation required depends on the release frequency, that is, on the reliability of the preventive SSCs. For example, assume that the only viable preventive SSCs assure that the frequency of release is less than 10^{-2} per year, but more than 10^{-4} per year. This frequency is not acceptable for events that have SL-2 level consequences, but is acceptable for events that have SL-3 level consequences. Therefore, the control strategy would need to provide enough mitigation to reduce the consequences of the release to the levels associated with a SL-3 event, as a minimum. The combined reliability of the preventive SSCs and the SSCs that provide mitigation needs to satisfy the target frequency for a SL-2 event. That is, the probability that the SSCs that provide mitigation will fail should be on the order of 10^{-2}, given the release.

- SSCs in control strategies for SL-2 events should satisfy the single failure criteria in the Implementing Standard for Defense in Depth.

For SL-3 and SL-4 events:

- The mitigation provided by the secondary confinement would be adequate to satisfy SRD Safety Criterion 2.0-1. It would also be adequate to satisfy SRD Safety Criteria 1.0-3 through 1.0-5. However, preventive features should be considered consistent with the defense in depth principle.

- A single preventive SSC may satisfy the frequency goal for SL-3 and SL-4 events.

- SSCs in control strategies for SL-3 and SL-4 events need not satisfy the single failure criteria in the Implementing Standard for Defense in Depth.

Notwithstanding the foregoing guidance on control strategy selection, administrative controls alone may be credited as the controls that protect facility workers, when appropriate. Timely evacuation from the vicinity of the hazard is considered to be an administrative control.

6.0 CLASSIFICATION OF STRUCTURES, SYSTEMS, AND COMPONENTS

The design classification process used on the TWRS-P Project provides a consistent, project-wide approach for the classification of the TWRS-P Facility SSCs based on their importance to controlling normal releases and accident prevention and mitigation. This approach ensures that SSCs are designed, constructed, fabricated, installed, tested, operated, and maintained to quality standards commensurate with the importance of the functions that need to be performed. As the facility moves to deactivation, and the safety functions change, the classification of SSCs can be revised as necessary.

BNFL Inc. has established a design classification system to provide assurance to DOE that the defined safety functions of SSCs will perform as intended.

BNFL prepared its "TWRS-P Project Quality Assurance Program and Implementation Plan" (QAPIP, BNFL-5193-QAP-01) specifically for work performed on or for the Tank Waste Remediation System – Privatization Project for the Part B scope of the work. The QAPIP is in conformance with 10 CFR 830.120 (Ref. 5.1) and with the top-level principles stated in DOE/RL-96-0006 (Ref. 5.4).

Administrative Controls

Administrative controls include features to control process variables to values within safe conditions, to alert operating personnel of an approach toward conservative process limits, to allow timely detection of failure or malfunction of critical equipment, and to allow for the imposition of administrative controls assumed in the hazard analysis, and/or accident analysis (Ref. 5.3).

The primary means of implementing defense in depth is through the provision of multiple physical barriers that maintain confinement. The output of the design process, through which hazards and hazardous situations are identified, control strategies implemented and standards defined will be a set of SSCs that achieve defense in depth. SSCs so identified will always be backed up by administrative controls such as procedures. Administrative controls that afford a measure of defense in depth will be developed prior to facility operations. For the purpose of protecting the public and co-located workers, a~~A~~dministrative controls alone shall not be relied on for the implementation of defense in depth. Administrative controls alone may be credited as the controls that protect facility workers, when appropriate. In such cases, defense in depth is provided through other human aspects, such as worker qualification and training.

Internal Safety Reviews

The TWRS-P Safety Requirements Document (BNFL-5193-SRD-01), Safety Criterion 7.1-3, requires that BNFL establish a safety framework and specifies requirements for the Internal Safety Oversight program consistent with Top-Level Principle 4.4.1, "Safety Review Organization." BNFL has established a TWRS-P Project Safety Committee (PSC) to provide an independent, interdisciplinary evaluation of matters related to nuclear, radiological, and process safety.

Operating Limits (Technical Safety Requirements)

The TWRS-P Safety Requirements Document (BNFL-5193-SRD-01), Safety Criterion 9.2-1, commits BNFL Inc. to prepare, submit for approval, and operate the facility in accordance with Technical Safety Requirements (TSRs). SCs 9.2-2 through 9.2-6 provide the safety criteria for the bases and contents, updating, submission for regulatory approval, and maintenance of TSRs.

As part of hazard evaluation, the role of the operator in the development of a potential hazard will be identified and reliability assessed. Human factors specialists in the multidisciplinary team will support this evaluation. The results of the assessment will be incorporated into administrative controls such as operating procedures and TSRs.

strategyies that protect the public and co-located workers ~~for defense in depth~~, such SSCs will always be backed up by the human aspects of defense in depth discussed in Section 2.6.

The table lists the number and attributes of the physical barriers, as well as the application of the single failure criterion to SSCs that are required to adequately implement defense in depth for a given control strategy. Confirmation of the adequacy of implementation is achieved by meeting the numerical guidance stated in the third column. Consistent with the defense in depth sub-principles in Section 2.0, the control strategy should emphasize passive SSCs over active SSCs.

Hazard severities and target frequencies are the means to achieve adequate defense in depth in accordance with the tailored approach mandated by RL/REG 98-17, "Regulatory Unit Position on Tailoring for Safety."

1st Column – SL (Severity Level)

Determination of hazard severity level is based on an assessment of unmitigated consequences. Severity levels are defined as SL-1 to SL-4, with SL-1 having the highest consequences.

2nd Column – Control Options for Implementation of Defense in Depth

A graded approach is reflected in the configuration requirements against each hazard severity level. The requirements are more stringent for defense in depth implementation for hazards of greater severity than for those of lesser severity.

Implementation of defense in depth requires that the single failure criterion be applied in a tailored fashion. For SL-1, application of the single failure criterion is mandatory. For SL-2, the single failure criterion shall be considered; that is, an objective assessment must be performed to determine the extent to which the single failure criterion will be incorporated into or be satisfied by design. The results and basis of this assessment shall be documented. Such documentation shall be retrievable and can be in the form of engineering studies, meeting minutes, reports, internal memoranda, etc. The single failure criterion is discussed in Section 2.1.

In addition to the single failure criteria in Table 1, diversity may also be implemented in the control strategy where hazards assessment reveals a common mode failure concern (see the Implementing Standard for Safety Standards and Requirements Identification, SRD Vol II, Appendix A).

Implementation of defense in depth also requires that the provision of physical barriers be applied in a tailored fashion. In Table 1, provision of physical barriers refers to those that provide confinement against the release of hazardous materials, as opposed to barriers that protect against direct radiation. For SL-1 and SL-2, two or more independent physical barriers are required. For SL-3, at least one physical barrier shall be provided, and two or more independent physical barriers shall be considered; that is, an objective assessment must be performed to determine the extent to which physical barriers will be incorporated by the design.

The results and basis of this assessment shall be documented. Such documentation shall be retrievable and can be in the form of engineering studies, meeting minutes, reports, internal memoranda, etc. For SL-4, at least one physical barrier shall be provided.

The graded approach is also reflected in the degree of confidence required commensurate with the hazard severity. The confidence is based on the standards and other attributes applicable to the particular control strategy. The Implementing Standard for Safety Standards and Requirements Identification describes selection of standards and other attributes applicable to control strategies.

3rd Column - Target Frequency (yr^{-1})

This column lists the target frequencies for each hazard severity level. The hazard severity level is a measure of the consequence from an unmitigated event – that is, an event in which both SSCs that prevent the accident and SSCs that mitigate the accident fail. After the preferred hazard control strategy has been identified, the event frequency – i.e., the product of the frequency of the initiating event and the probability that the control strategy will fail given the initiating event – will be conservatively estimated. (No credit is taken for administrative controls in calculating the initiating event frequency.) Verifying that the event frequency is less than the target frequency will provide confirmation that the chosen control strategy includes sufficient SSCs to adequately implement defense in depth in a graded approach.

The demonstration of having met the target frequencies may be based on either numerical analysis or engineering judgment. When appropriate, administrative controls alone may be credited as the controls that protect facility workers. The hazard assessment and control team shall assess the confidence in the frequency so determined, applying greater conservatism where engineering judgment is employed.

Table 1. Implementation of Defense in Depth by SSCs.

Severity Level	Control Options for Implementation of Defense in Depth	Target Frequency (yr^{-1})
SL-1	Two or more independent physical barriers. The single failure criterion shall be applied.	$< 10^{-6}$
SL-2	Two or more independent physical barriers. The single failure criterion shall be considered.	$< 10^{-4}$
SL-3	At least one physical barrier shall be provided. Two or more independent physical barriers shall be considered.	$< 10^{-2}$
SL-4	At least one physical barrier.	$< 10^{-1}$